

2001 Chevrolet S10 Pickup
2000-01 ENGINES 2.2L 4-Cylinder

2000-01 ENGINES

2.2L 4-Cylinder

ENGINE IDENTIFICATION

VEHICLE IDENTIFICATION NUMBER (VIN)

The VIN is stamped on metal pad located near lower left corner of windshield. The "4" in eighth character of VIN identifies 2.2L 4-cylinder engine.

BROADCAST CODE LABEL & PARTIAL VIN

The Broadcast Code label is located on the valve rocker arm cover. It identifies engine, transaxle, and vehicle relationship. The partial VIN (9 characters) is stamped on flange on left side of cylinder block, above starter.

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

Engine is equipped with non-adjustable hydraulic valve lifters.

TROUBLE SHOOTING

NOTE: To trouble shoot engine mechanical components, see appropriate table in TROUBLE SHOOTING article in GENERAL INFORMATION.

REMOVAL & INSTALLATION

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

NOTE: For reassembly reference, label all electrical connectors, vacuum hoses and fuel lines before removal. Also place mating marks on engine hood and other major assemblies before removal.

FUEL PRESSURE RELIEF

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Raise vehicle. Disconnect fuel pump electrical connector. Lower vehicle. Start and run engine until fuel supply in pipes is consumed. Engage starter for 3 seconds to assure relief of remaining pressure. Raise vehicle. Reconnect fuel pump electrical connector. Lower vehicle. Disconnect negative battery cable to avoid accidental engine start-up.

S10 Pickup & Sonoma

Turn ignition off. Disconnect negative battery cable. Loosen fuel tank filler cap to release tank vapor pressure. Wrap shop towel around fitting while connecting Fuel Pressure Gauge (J-34730-1A) to fuel pressure connection. Install gauge bleed hose into container. Open gauge valve to bleed system pressure. Drain remaining fuel in pressure gauge into container.

ENGINE

Removal (Cavalier & Sunfire - M/T)

1. Release fuel system pressure. See **FUEL PRESSURE RELIEF** . Disconnect negative battery cable. Drain cooling system. Remove air cleaner outlet resonator fasteners and outlet duct. Remove crankcase vent hose from top of engine, and remove outlet resonator. Remove upper and lower radiator hoses from engine.
2. Disconnect brake booster vacuum hose. Disconnect following electrical connections: IAC, generator, Throttle Position (TP) sensor, MAP, EVAP emission solenoid, injector harness, Engine Coolant Temperature (ECT) sensor, oxygen (O2S) sensor, and engine grounds. On 2000 models, disconnect EGR electrical connection. Remove accelerator and cruise control cables from bracket. Disconnect engine grounds electrical connection.
3. Remove drive belt. Disconnect transaxle shift control cable from lever and bracket. On 2001 models, disconnect hydraulic clutch line. Remove coolant surge tank and connections. Disconnect vacuum line near master cylinder. Raise vehicle, allowing suspension to hang freely. Remove wheel assemblies and front fender liners. Remove right engine splash shield, using Door Trim Pad & Garnish Clip Remover (J-38778) to remove push-in retainers. Remove engine mount strut.
4. For 2001 models, go to step 5 . For 2000 models, support 3-way catalytic converter, and remove intermediate pipe bolts. Remove exhaust manifold bolts. Remove catalytic converter bracket, and remove catalytic converter and seals. Clean flange surfaces. Go to step 6 .
5. On 2001 models, remove front exhaust pipe by supporting 3-way catalytic converter, and cutting intermediate pipe at muffler. Remove intermediate pipe bolts at catalytic converter, and remove intermediate pipe from hanger. Remove 3-way catalytic converter seals, and clean flange surface.
6. Disconnect ABS electrical connector, and remove harness from lower controls arms. Remove lower pinch bolt from steering gear. Remove stabilizer bar from knuckles. Support front suspension crossmember with suitable jackstand. Remove crossmember mounting bolts. Remove crossmember extension brace and crossmember. See **Fig. 1** .

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Remove stabilizer bar brackets, and remove stabilizer bar from vehicle. Remove outer tie rods by loosening jam nut, removing tie rod end nut, and pulling tie rod with Universal Steering Linkage Puller (J-24319-B). If brake pipe runs along support frame, remove from retainers.

7. Remove PS hoses from steering gear. Remove lower control arm-to-knuckle fasteners, and remove ball joint using Ball Joint Separator (J-43828). Remove wiring harness and mounting bolts from lower control arm. Remove lower control arm. Remove power steering gear mounting bolts. Remove steering gear.
8. Disconnect A/C compressor electrical connector. Remove compressor clutch electrical connector. Remove compressor, and support with lines attached. Disconnect vehicle speed sensor electrical connection. On 2000 models, disconnect cooling fan electrical connection. Remove starter electrical connections. On 2001 models, remove wiring harness bracket nut from starter bolt. On all models, remove flywheel inspection shield, and remove starter from vehicle. Disconnect oil pressure sensor electrical connector. Disconnect ground wires.
9. Insert drift into rotor to prevent rotor from turning, and remove drive shaft nut. Install Front Hub Spindle Remover (J-28733-B) onto wheel hub, and support drive shaft until fully removed from vehicle. Disengage drive shaft splines from hub/bearing assembly with front hub spindle remover. Assemble Wheel Drive Shaft Remover (J-33008-A), Axle Shaft Remover Extension (J-29794) and Slide Hammer (J-2619-01), and disengage drive shaft from transaxle. Remove drive shaft from vehicle. Lower vehicle until engine/transmission assembly is on support table
10. Lower vehicle. Remove air inlet duct. Reposition ignition control module. Remove ICM electrical connectors and spark plug wires. Remove ignition coils bolts. Remove ignition coils and ICM assembly. Disconnect heater hoses from heater pipes. Raise vehicle. Disconnect heater hoses from heater core, and remove hoses from vehicle. Lower vehicle.
11. Remove air cleaner assembly, if necessary. Using Fuel Line Quick-Connect Separator (J-37088-A), disconnect quick-connect fitting at engine compartment fuel return pipe. Remove fuel return pipe from fuel pressure regulator, discard "O" ring, and plug openings. Remove washer solvent container/air induction assembly, and disconnect connections (remove front headlight if necessary). Use wood block and jack stand, and remove front and rear transaxle mount through-bolts. Install Engine Support Fixture (J-28467-360) and raise engine off mount. Raise vehicle. Separate engine from transaxle.

Installation

To install, reverse removal procedure. Tighten all fasteners to specification. See **TORQUE SPECIFICATIONS** . Apply engine oil to crankcase vent hose when installing. When installing tie rod into knuckle, use NEW prevailing torque nut. Apply dielectrical grease to inside of boot when installing spark plug wires. Use NEW "O" rings when installing fuel pipes, and lubricate male pipe ends. Bleed power steering system. Refill fluids. Check oil, fuel and coolant systems for leaks. Check front wheel toe and alignment.

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Removal (Cavalier & Sunfire - A/T)

1. Release fuel system pressure. See **FUEL PRESSURE RELIEF** . Disconnect negative battery cable. Install protective covering over fenders. Remove hood insulator, if equipped, using Door Trim Pad & Garnish Clip Remover (J-38778). Remove hood front seal, if equipped. Remove hood latch striker. Mark upper hood hinge-to-hood location for installation reference. Remove hood hinge bolts, and remove hood.
2. Drain cooling system. Recover A/C system. See appropriate REFRIGERANT RECOVERY AND RECHARGING article in HEATING AND AIRCONDITIONING. On 2000 models, remove air cleaner outlet duct, battery and connections, and air cleaner assembly. On 2001 models, remove air cleaner outlet duct, crankcase vent hose from top of engine, and outlet resonator. On all models, disconnect brake booster vacuum line at intake manifold. Remove resonator bracket/fuel injector rail cover.
3. Remove accelerator and cruise control cables from cable bracket. Disconnect engine wiring harness from underhood engine components. Disconnect electrical connector from cruise control module. Open throttle body cam slightly. Remove cruise control cable from throttle body cam lever, throttle body bracket, engine retainer clip and cruise control module. Disconnect cruise control cable slug from ribbon buckle. Remove cruise control cable from engine compartment. Remove cruise control bracket and module.
4. Raise vehicle. Remove refrigerant tubes from accumulator. Remove accumulator bracket, and discard "O" rings. Remove drive belt. Remove radiator surge tank and connections. Remove upper and lower radiator hoses. For 2001 models, go to next step. For 2000 models, go to step 7 .
5. On 2001 models, remove power steering pump from accessory bracket, with hoses attached. Remove air cleaner outlet splash shield, LH headlight assembly, and electrical connectors. Remove front air cleaner intake duct upper push-in retainer. Remove left front wheel and wheel house panel. Remove front air cleaner intake duct lower push-in retainer. Remove front air cleaner intake duct through headlight assembly opening. Go to next step.
6. On 2001 models, remove resonator fasteners, and remove resonator through wheel house opening. Remove ICM electrical connectors and spark plug wires. Remove ignition coils bolts. Remove ignition coils and ICM assembly. Disconnect heater hoses from heater pipes. Disconnect heater hoses from heater core, and remove hoses from vehicle. Go to next step.
7. Remove air cleaner assembly. Disconnect quick-connect fitting at engine compartment fuel return pipe using Fuel Line Quick-Connect Separator (J-37088-A). Remove fuel return pipe from fuel pressure regulator, discard "O"ring, and plug openings.
8. Raise vehicle. On 2000 models, remove exhaust manifold heat shield, radiator hose from coolant inlet pipe-to-oil pan bolt, coolant inlet pipe cover, coolant inlet pipe and seal. For all models, remove right-side wheel assembly. Remove right engine splash shield, using Door Trim Pad & Garnish Clip Remover (J-38778) to remove push-in retainers. Remove right fenderliner. Remove right engine splash shield. Remove engine

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mount strut.

9. Remove flywheel inspection cover. Remove wiring harness bracket nut from starter bolt. Remove electrical connections from starter. Remove starter from vehicle. Disconnect A/C compressor electrical connector. Remove compressor clutch electrical connector. Remove compressor, and support with lines attached.
10. Disconnect vehicle speed sensor electrical connection. Remove front exhaust pipe by supporting 3-way catalytic converter, and removing intermediate pipe bolts. Remove exhaust manifold bolts and catalytic converter bracket bolts. Remove catalytic converter and seals, and remove intermediate pipe from hanger. Clean flange surface.
11. Drain engine oil. Remove torque converter bolts. Remove transmission-to-engine support brace. Remove lower transmission-to-engine bolts. Lower vehicle. Support transmission with suitable jack. Install Engine Support Fixture (J-28467-360), and raise engine off of mount. Remove engine mount assembly. Remove remaining transaxle-to-engine bolts. Separate engine from transaxle, and lift engine from vehicle.

Installation

To install, reverse removal procedure. Tighten all fasteners to specification. See **TORQUE SPECIFICATIONS** . Adjust hood as necessary. When installing accelerator cable, use NEW cable. Apply dielectrical grease to inside of boot when installing spark plug wires. Use NEW "O" rings when connecting fuel return pipe to fuel pressure regulator. Apply engine oil to male pipe ends. Bleed power steering system. Refill fluids. Check oil, fuel and coolant systems for leaks.

Removal (Sonoma & S10 Pickup)

1. Release fuel system pressure. See **FUEL PRESSURE RELIEF** . Disconnect negative battery cable. Install protective covering over fenders. Remove right and left air inlet grille panels. Remove wire under hood lamp, if equipped. Remove windshield washer nozzles. Remove hood fasteners, and remove hood from vehicle.
2. If vehicle is equipped with M/T, shift into 3rd or 4th gear and remove shifter console, shifter, and shifter boot. Raise and support vehicle. Disconnect heated oxygen sensor (HO2S) electrical connection. Remove catalytic converter-to-exhaust manifold pipe flange nuts. Remove muffler-to-catalytic converter flange nuts. Remove muffler. Remove catalytic converter from hanger, and remove from vehicle. Remove heated oxygen sensors (HO2S) as necessary. Remove exhaust manifold pipe-to-manifold bolts, and remove exhaust manifold pipe and seal from vehicle.
3. Remove oil filter drain deflector from brace rod, if equipped. Remove engine-to-transmission brace rod. Remove starter heat shield. Disconnect wires from starter solenoid, and remove starter. Remove transmission from vehicle. For M/T, see appropriate article in CLUTCHES. For A/T, see TRANSMISSION REMOVAL & INSTALLATION article in TRANSMISSION SERVICING.
4. Remove O2S electrical sensor. Carefully back out sensor and seal using Oxygen Sensor

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- Wrench (J-29533-A/BT-8127). Remove right wheelhouse splash shield. Remove generator rear brace. Remove bolts holding negative cable and ground wires to engine. Disconnect the following: engine oil pressure gauge, Camshaft Position (CMP), Crankshaft Position (CKP), and Knock (KS) sensors. Disconnect both ignition control module electrical connectors. Disconnect EVAP purge canister solenoid valve electrical connector. Lower vehicle.
5. Remove bolt holding EVAP emission canister purge harness. For A/T vehicles, remove A/T fluid fill tube from intake manifold. Remove nuts holding engine wiring harness clip to intake manifold and intake manifold rear lower stud. Remove air cleaner outlet resonator screw and clamp. Remove outlet duct from resonator. Disconnect vacuum brake booster hose at throttle body. Remove crankcase vent hose from top of engine. Remove air cleaner outlet resonator.
 6. Drain coolant from radiator. Disconnect coolant recovery reservoir hose. Remove radiator hose clamps. Disconnect upper radiator hose from radiator. Remove intake duct assembly from fan shroud. Remove upper fan shroud screws. Disconnect coolant recovery reservoir hose from lower fan shroud. Remove upper fan shroud. Disconnect radiator hoses from radiator. If vehicle is equipped with engine/transmission oil cooler lines, remove air cleaner, and remove cooler lines from radiator. Lift lower fan shroud just enough to disengage locating tabs. Remove radiator.
 7. Remove drive belt. Remove A/C compressor, with lines attached, disconnecting electrical connections as necessary. Remove fan clutch from coolant pump using Fan Clutch Wrenches (J-41240-1 and J-41240-2). Remove fan from fan clutch as assembly. Remove power steering pump pulley using Power Steering Pump Pulley Remover (J-25034-C). Remove power steering pump, with hoses attached.
 8. Disconnect heater hoses from heater core. Disconnect heating and A/C control vacuum source hose. Disconnect EVAP emission purge tube from throttle body. Remove data link connector (DLC). Remove sound insulator-to-knee bolster/cowl panel screws, and disconnect necessary electrical connectors. Remove sound insulator. Remove accelerator control cable from slot in pedal assembly. Remove accelerator cable from bracket and throttle lever cam, and remove from vehicle.
 9. Disconnect cruise control cable from throttle shaft. Remove positive battery cable cover from underhood fuse block. Remove positive battery cable.
 10. If vehicle is not equipped with coolant heater, remove coolant jacket plug by tapping on outer edge, then removing with pliers. Remove cord from coolant heater, and remove coolant heater. Disconnect electrical connections from generator. Disconnect following electrical connectors from top of engine: engine coolant temperature sensor, idle air control motor, manifold absolute pressure, and throttle position sensor. Disconnect fuel injector harness electrical connector. Remove harness from bracket on valve rocker arm cover, and secure aside. For 2000 models, go to step 11. For 2001 vehicles, go to step 12.
 11. Disconnect fuel pipes from fuel rail assembly. Remove transmission. See TRANSMISSION REMOVAL & INSTALLATION article in TRANSMISSION

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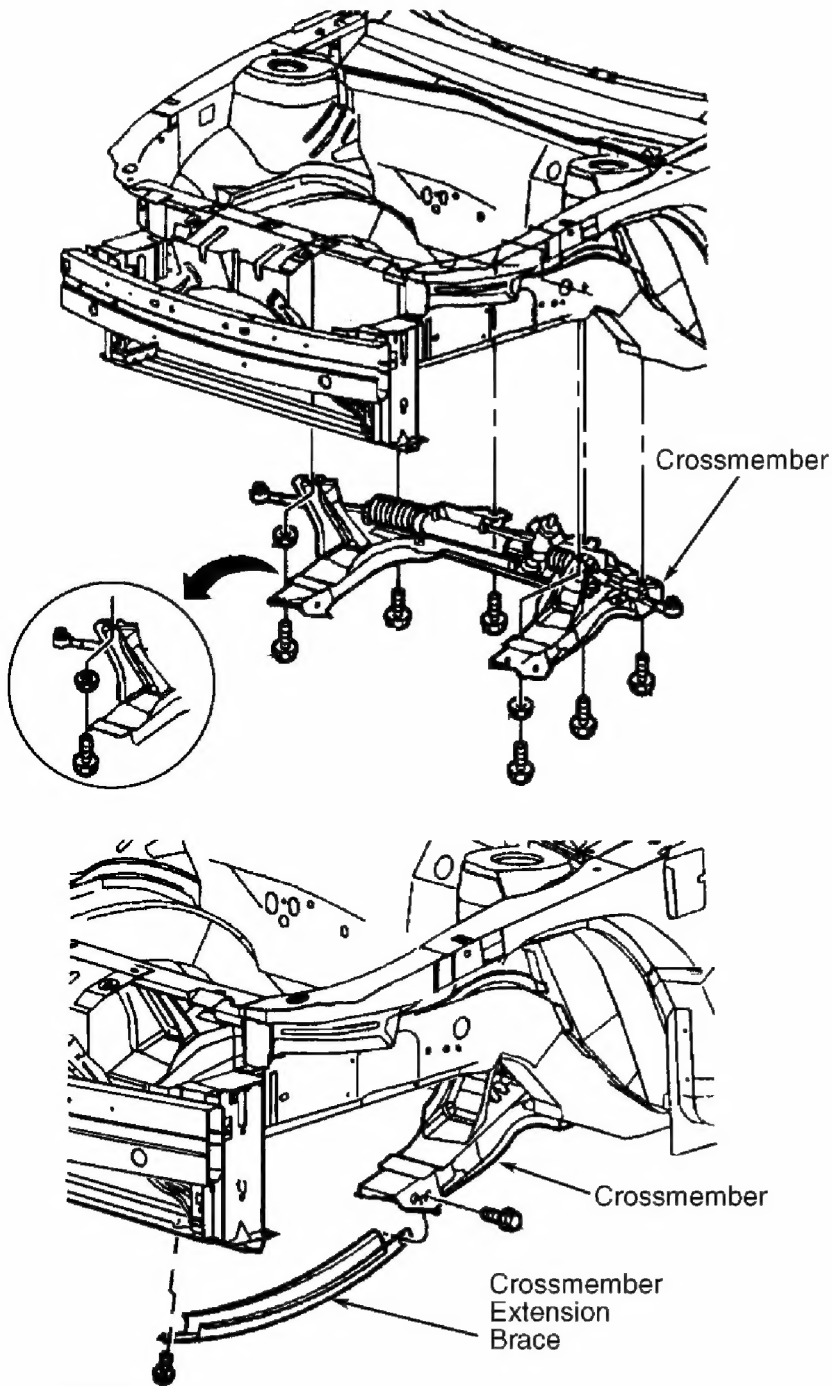
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SERVICING. Disconnect fuel pipe connections from fuel filter assembly. Use Fuel Line Disconnect Tool Set (J-37088-A) to disconnect metal fitting. Cap pipes. Remove engine mount through-bolts. Install suitable engine lifting device to engine. Remove engine from vehicle.

12. For 2001 models, remove intake manifold. See **INTAKE MANIFOLD** under REMOVAL & INSTALLATION. Remove fuel injector electrical connectors from fuel injector. Remove boot, then disconnect fuel feed pipe from fuel composition sensor. Use Fuel Line Disconnect Tool Set (J-37088-A) to disconnect metal collar. Cap pipes. Remove engine mount through-bolts. Install suitable engine lifting device to engine. Remove engine from vehicle.

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Fig. 1: Removing Crossmember Assembly
Courtesy of GENERAL MOTORS CORP.

Installation

1. To install, reverse removal procedure. Tighten all fasteners to specification. See **TORQUE SPECIFICATIONS** . Apply lubricant to wash hose connectors when

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- installing. Install NEW catalytic converter gasket. Install NEW exhaust manifold seal.
2. Align yellow paint marks when installing fan clutch hub onto water pump hub. Use Power Steering Pump Pulley Installer (J-25033-C) when installing pump pulley. Allowable variance between pump pulley and shaft is .010 inches (.25 mm). Install NEW seals and retainer rings onto engine oil cooler lines when installing.
 3. Apply Lubricant (9985662) to inlet/outlet heater hoses when installing. Replace accelerator control cable with NEW cable. Apply lubricant to "O" ring seal and coolant plug opening surface when installing plug. Apply engine oil to male pipe ends when connecting fuel pipe fittings. Apply engine oil to fuel injector "O" rings when installing. Refill fluids. Check oil, fuel and coolant systems for leaks.

INTAKE MANIFOLD

Removal (Cavalier & Sunfire)

1. Release fuel system pressure. See **FUEL PRESSURE RELIEF** . Disconnect negative battery cable. Remove air cleaner inlet duct, resonator and resonator bracket/fuel rail. Remove accelerator and cruise control cables with bracket, if equipped.
2. Disconnect vacuum hoses and electrical connectors from throttle body and intake manifold. Remove following electrical connections: idle air control (IAC) valve and throttle position (TP) sensor. Remove throttle body from intake manifold.
3. Disconnect MAP sensor. Disconnect vacuum hose from fuel pressure regulator. Disconnect fuel injector electrical connection. Disconnect fuel feed quick connect fitting using Fuel Line Quick-Connect Separator (J-37088-A), if necessary, and disconnect return pipe from fuel pressure regulator. Remove fuel rail fasteners, and remove fuel rail. Remove and discard injector lower "O" ring seals.
4. Disconnect following electrical connections. EVAP purge solenoid, camshaft sensor, crankshaft sensor, VSS, knock sensor, back-up light switch, oxygen sensor, and oil pressure switch. Lower vehicle. Unroute wiring harness. Remove intake manifold fasteners, and remove from vehicle.

Removal (Sonoma & S10 Pickup)

1. Release fuel system pressure. See **FUEL PRESSURE RELIEF** . Disconnect negative battery cable. Remove upper fan shroud. Remove air cleaner resonator clamp and mounting screw. Remove outlet duct from resonator. Disconnect power brake booster vacuum hose. Remove crankcase vent hose from top of engine. Remove air cleaner outlet resonator.
2. Disconnect following electrical connectors: idle air control motor, manifold absolute pressure sensor, throttle position sensor, and fuel injector harness. Remove fuel injector harness connector from bracket on valve rocker arm cover, and remove wiring harness. Disconnect heating and A/C control vacuum source hose. Disconnect EVAP emission purge tube from throttle body. Remove bolt securing EVAP emission canister purge harness and transaxle fluid fill tube. Remove nuts securing engine wiring harness clip

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to intake manifold and intake manifold rear lower stud.

3. Clean surrounding areas, and remove fuel pipe from fuel rail. Cap fuel pipe. Remove left sound insulator, and remove accelerator and cruise control cables from throttle body. Remove spark plug wires from spark plugs. Remove spark plug wire harness from thermostat assembly, and set aside.
4. Remove right fender wheelhouse extension. Remove generator brace. Remove engine wiring harness bracket at back of engine. Remove intake manifold bolts and nuts. Remove fuel rail bracket. Remove intake manifold.

Installation

To install, reverse removal procedure. Use a NEW gasket. Use NEW fuel injector "O" ring seals when installing lines. Tighten fasteners to specification, starting with upper center bolt and working outward in both directions. See **TORQUE SPECIFICATIONS** .

EXHAUST MANIFOLD

Removal (Cavalier & Sunfire)

1. Disconnect negative battery cable. Remove oxygen sensor lead. Disconnect generator electrical connections. Remove drive belt. Remove generator rear brace and generator assembly.
2. Raise vehicle. Support 3-way catalytic converter, and cut intermediate pipe at muffler. Remove intermediate pipe from 3-way catalytic converter and hanger. Remove 3-way catalytic converter seals. Remove exhaust pipe from exhaust manifold. Remove radiator inlet pipe. Lower vehicle. Remove oil fill tube assembly. Remove exhaust manifold and gasket.

Removal (Sonoma & S10 Pickup)

1. Disconnect negative battery cable. Raise vehicle. Remove drive belt. Disconnect heated oxygen sensor (HO2S) electrical connection. Remove catalytic converter from vehicle. Remove exhaust manifold pipe and seal from vehicle. Lower vehicle.
2. Remove air intake duct from fan shroud. Remove upper fan shroud, and disconnect radiator hose from lower fan shroud. Remove A/C compressor, and set aside with hoses attached. Remove power steering pump, and set aside with hoses attached.
3. Remove oil fill tube assembly. Disconnect oxygen sensor electrical connection. To avoid damage, remove sensor from exhaust manifold. Remove air injection pipe from manifold. Remove exhaust manifold and gasket.

Installation

Clean mating surfaces on intake manifold and cylinder head. Inspect manifold for cracks, broken flanges and gasket surface damage. To install, reverse removal procedure. Use NEW exhaust manifold and catalytic converter gaskets. Install NEW exhaust manifold pipe seal.

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Ensure indicated fasteners are tightened in correct sequence. See **TORQUE SPECIFICATIONS** . Tighten all fasteners to specification.

CYLINDER HEAD

NOTE: **When removing valve train components, keep them in order to ensure installation in same location.**

Removal (Cavalier & Sunfire)

1. Disconnect negative battery cable. Release fuel system pressure. See **FUEL PRESSURE RELIEF** . Remove drive belt. Remove air cleaner outlet resonator fasteners. Remove outlet duct. Disconnect hoses, and remove resonator assembly. Disconnect low coolant connector. Remove radiator surge tank, and disconnect hoses. Disconnect coolant return hose. Remove coolant recovery tank.
2. Install Engine Support Fixture (J-28467-360), and raise engine off mount. Remove engine mount assembly. Remove intake manifold. See **INTAKE MANIFOLD** . Remove exhaust manifold. See **EXHAUST MANIFOLD** .
3. Disconnect engine coolant temperature sensor (ECT) electrical connection. Raise vehicle. Drain and recover cooling system. Lower vehicle. Remove resonator and duct assembly. Remove resonator bracket/fuel rail cover. Remove left engine wiring harness bracket. Remove valve rocker arm cover. Remove rocker arms and push rods.
4. Remove power steering pump and set aside with lines attached. Remove exhaust manifold heat shield. Remove coolant inlet pipe through exhaust manifold. Raise vehicle. Remove radiator hose from coolant inlet pipe-to-oil pan bolt. Remove inlet pipe bolt cover, inlet pipe and seal.
5. Remove air cleaner outlet from air cleaner. Remove ICM electrical connectors and spark plug wires. Remove ignition coil bolts. Remove accessory bracket. Disconnect secondary ignition wires from spark plugs. Install Engine Support Fixture (J-28467-360). Remove cylinder head bolts. Remove cylinder head.

Removal (Sonoma & S10 Pickup)

1. Release fuel system pressure. See **FUEL PRESSURE RELIEF** . Disconnect negative battery cable. Drain cooling system. Remove intake duct assembly from fan shroud. Disconnect coolant recovery reservoir hose from shroud. Remove upper fan shroud. Using 2 Fan Clutch Wrenches (J-41240), remove fan and fan clutch as assembly. Remove fan from clutch. Remove drive belt. Remove fan pulley.
2. Raise vehicle. Remove generator rear brace from engine. Remove generator. Recover refrigerant from system. Remove compressor suction/discharge hose assembly, and cap. Disconnect A/C compressor electrical connection. Remove compressor from brackets. Remove brackets. Remove power steering hoses from pump, and cap. Remove PS pump pulley using Power Steering Pump Pulley Remover (J-25034-C). Remove power steering pump mounting fasteners, and remove from vehicle.

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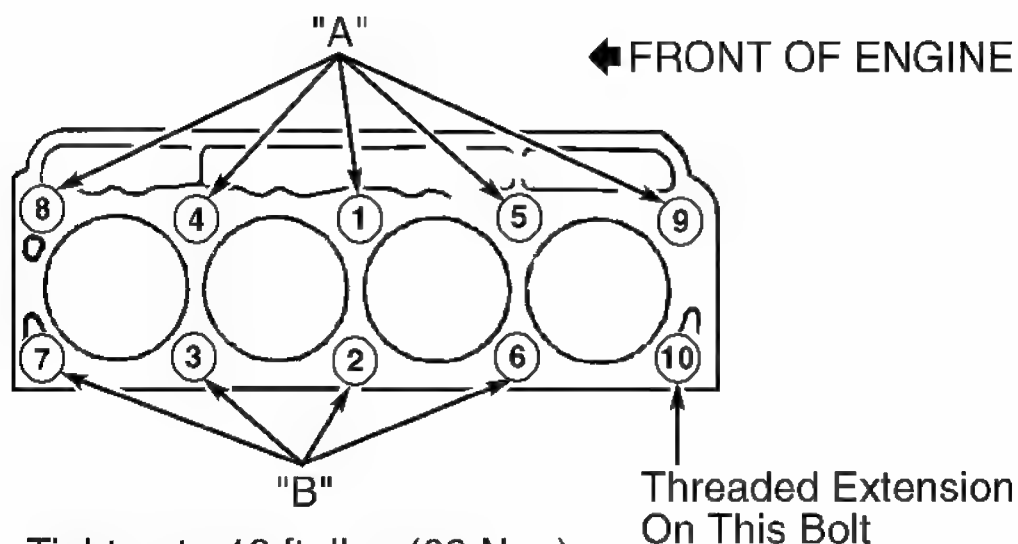
3. Remove air cleaner outlet resonator fasteners. Remove outlet duct. Disconnect hoses, and remove resonator assembly. Remove thermostat, "O" ring and housing from engine. Remove accessory mounting bracket from engine. Remove exhaust manifold. See **EXHAUST MANIFOLD** .
4. Disconnect power brake booster vacuum hose. Remove electrical connectors from idle air control valve and throttle position sensor. Remove vacuum hoses from throttle body. Remove data link connector from instrument panel left sound insulator. Remove screws attaching sound insulator to knee bolster and cowl panel. Remove remote control door lock receiver module and connections from sound insulator. Remove accelerator and cruise control cables from accelerator cable bracket. Remove bracket. Remove throttle body from intake manifold.
5. Remove spark plug wires from spark plugs. Disconnect fuel injector harness electrical connector, and remove from bracket on valve rocker arm cover. Remove engine wiring harness from bracket. Remove engine wiring harness bracket at rear of engine. Remove air cleaner outlet resonator bracket. Remove valve rocker arm cover and gasket. Remove rocker arm assemblies and pushrods.
6. Remove intake manifold. See **INTAKE MANIFOLD** under REMOVAL & INSTALLATION. Remove engine lift bracket from rear of engine. Remove cylinder head.

Inspection

Inspect cylinder head for warpage at head gasket surface and manifold surfaces. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. DO NOT remove more than .010" (.25 mm) of material from head gasket surface. Inspect for cracks in exhaust ports and combustion chambers. Inspect for external cracks in water chamber. Check valves for squareness, burned heads, cracked faces, or damaged stems.

Installation

Clean carbon from combustion chambers and valve parts with Wire Brush (J-8089). Clean valve pushrods, rocker arms, cylinder head, engine block gasket surfaces, and bolt hole threads in cylinder heads/engine block. Clean valve stems and heads on buffing wheel. Install NEW head gasket. Install cylinder head. Tighten cylinder head bolts to specification in proper sequence. See **Fig. 2** . To complete installation, reverse removal procedure. Tighten all fasteners to specification. See **TORQUE SPECIFICATIONS** . Use Power Steering Pump Pulley Installer (J-25033-C) when installing pulley.



A. Tighten to 46 ft. lbs. (62 N.m)

B. Tighten to 43 ft. lbs. (58 N.m)

NOTE: Tighten each bolt an additional 90 degrees.

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Fig. 2: Cylinder Head Bolt Tightening Sequence
 Courtesy of GENERAL MOTORS CORP.

FRONT COVER

Removal (Cavalier & Sunfire)

1. Disconnect negative battery cable. Remove drive belt. Raise vehicle. Remove front wheel assemblies. Remove right engine splash shield fasteners, using Door Trim Pad & Garnish Clip Remover (J-38778) to remove retaining clips. Remove wiring harness from clip, and remove splash shield. Remove engine mount strut. Lower vehicle.
2. Remove coolant recovery/surge tank bolt, and position tank aside. Install Engine Support Fixture (J-28467-360), and raise engine off mount. Remove engine mount assembly. Raise engine to access tensioner bolt, and remove tensioner. Disconnect generator electrical connections. Remove generator. Remove power steering pump and set aside with hoses attached.
3. Remove oil pan, See **OIL PAN** . Remove crankshaft pulley fasteners. Remove crankshaft pulley hub with Crankshaft Pulley Hub Puller (J-24420-B). Remove engine front cover. If necessary, carefully use rubber mallet to loosen cover.

Removal (Sonoma & S10 Pickup)

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1. Disconnect negative battery cable. Remove drive belt. Remove upper and lower fan shrouds. Using 2 Fan Clutch Wrenches (J-41240), remove fan and fan clutch as assembly. Remove fan from clutch.
2. Raise vehicle. Remove crankshaft pulley fasteners, and remove pulley using Crankshaft Pulley Hub Puller (J-24420-C). Remove crankshaft key. Replace if damaged. Remove drive belt tensioner assembly. Remove engine front cover and gasket.

Installation

Coat front cover mating surfaces with engine oil when installing front cover and NEW gasket. To complete installation, reverse removal procedure. Apply RTV Sealant (1052917) to crankshaft keyway before installing hub. Use Crankshaft Pulley Hub Installer (J-29113) when installing hub. Tighten all fasteners to specification. See **TORQUE SPECIFICATIONS** .

FRONT COVER OIL SEAL

Removal (Cavalier & Sunfire)

Disconnect negative battery cable. Remove drive belt. Raise vehicle. Remove right front wheel assembly. Remove right engine splash shield, using Door Trim Pad & Garnish Clip Remover (J-38778) to remove push-in retainer. Remove crankshaft pulley. Remove crankshaft pulley hub using Crankshaft Pulley Hub Puller (J-24420-B). Remove oil seal by prying with large screwdriver.

Removal (Sonoma & S10 Pickup)

Disconnect negative battery cable. Remove upper and lower fan shrouds. Remove drive belt. Remove crankshaft balancer bolt and washer. Remove crankshaft pulley fasteners, and remove pulley using Crankshaft Pulley Hub Puller (J-24420-B). Install a short bolt (with same threads) into crankshaft. Install Balancer Remover/Installer (J-23523-F) to remove crankshaft balancer. Tighten plate bolts to 25 Nm (18 ft. lbs.). Note position and length of any front groove pins for installation reference. Use suitable prying tool to remove front oil seal.

Installation

Coat seal contact area with engine oil, and install NEW oil seal using Cover Aligner/Seal Installer (J-35468). For Cavalier and Sunfire, apply RTV Sealant (1052917) to crankshaft keyway. For S10 and Sonoma, apply RTV Sealant (12346141) to crankshaft keyway. To complete installation, reverse removal procedure. When installing crankshaft pulley hub onto crankshaft, use Crankshaft Pulley Hub Installer (J-29113). Tighten all fasteners to specification. See **TORQUE SPECIFICATIONS** .

TIMING CHAIN & SPROCKETS

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NOTE: Before removing timing chain, measure distance between hole in bracket and unworn surface of tensioner shoe. If distance is more than .314" (8.00 mm), replace tensioner, chain and sprockets.

Removal

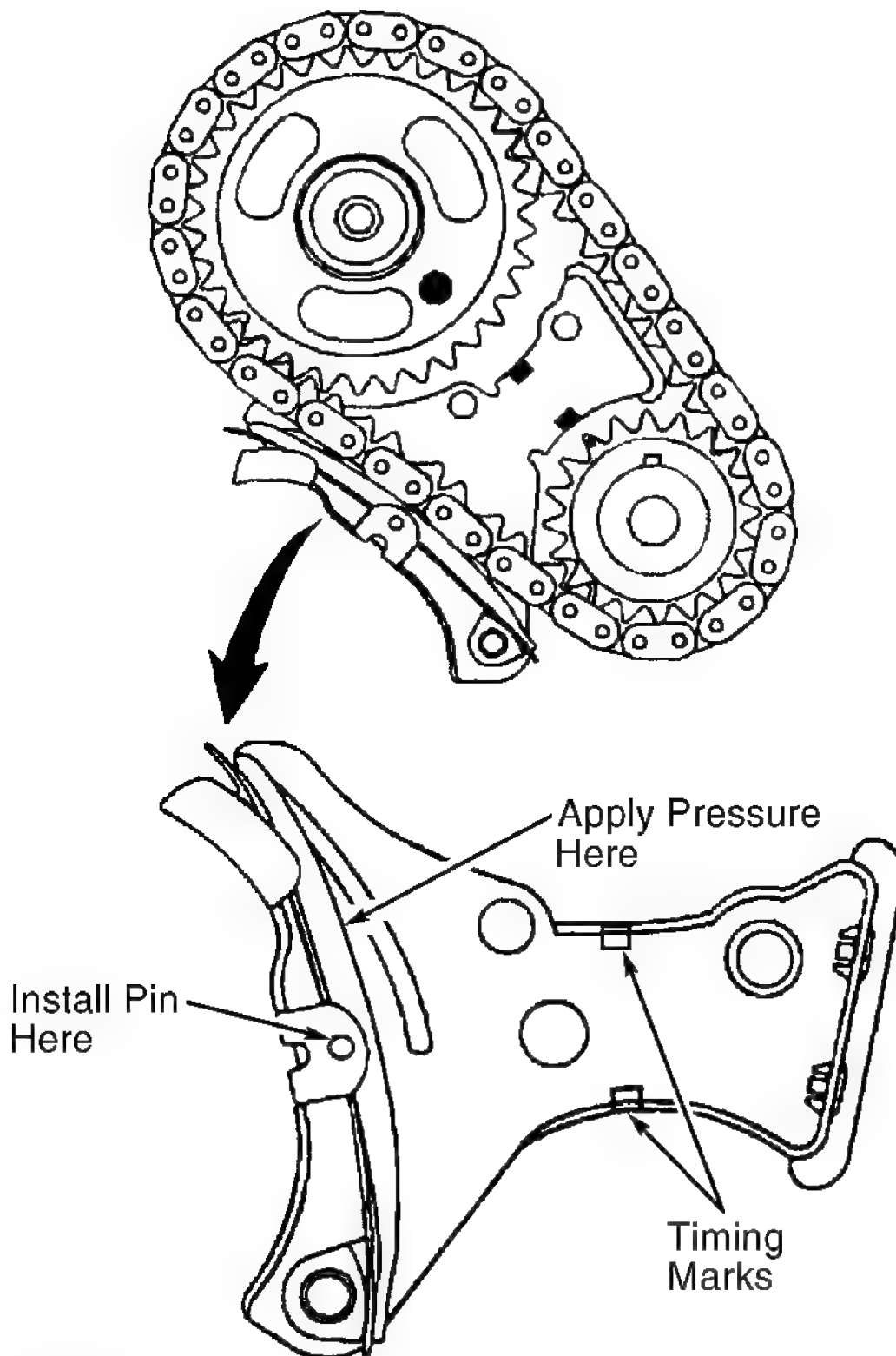
1. Remove engine front cover. See **FRONT COVER** . Align timing marks on camshaft sprocket and crankshaft sprocket with tabs on chain tensioner. See **Fig. 3** .
2. Remove timing chain tensioner bolts. Loosen, but DO NOT remove, timing chain tensioner Torx bolt. Remove camshaft sprocket bolt. Remove camshaft sprocket and timing chain. Remove timing chain tensioner Torx bolt and tensioner. Using Universal Two Jaw Puller (J-22888-20A), remove crankshaft sprocket.

Installation

1. Install crankshaft sprocket using Sprocket Installer (J-5590). Ensure crankshaft sprocket is fully seated against crankshaft. Compress chain tensioner spring, install a cotter pin or nail in hole of chain tensioner to retain timing chain tensioner shoe and install tensioner onto block. Do not tighten tensioner bolts at this time. Align timing mark on crankshaft gear with tab on timing chain tensioner. See **Fig. 3** .
2. Install camshaft sprocket and timing chain, aligning timing marks on sprocket with tab on timing chain tensioner. Tighten timing chain tensioner bolts. Install camshaft sprocket bolt and tighten to specification. Remove cotter pin from chain tensioner. Lubricate timing chain with oil. To complete installation, reverse removal procedure. Tighten all fasteners to specification. See **TORQUE SPECIFICATIONS** .

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Fig. 3: Aligning Timing Marks & Compressing Chain Tensioner Courtesy of GENERAL MOTORS CORP.

VALVE LIFTERS

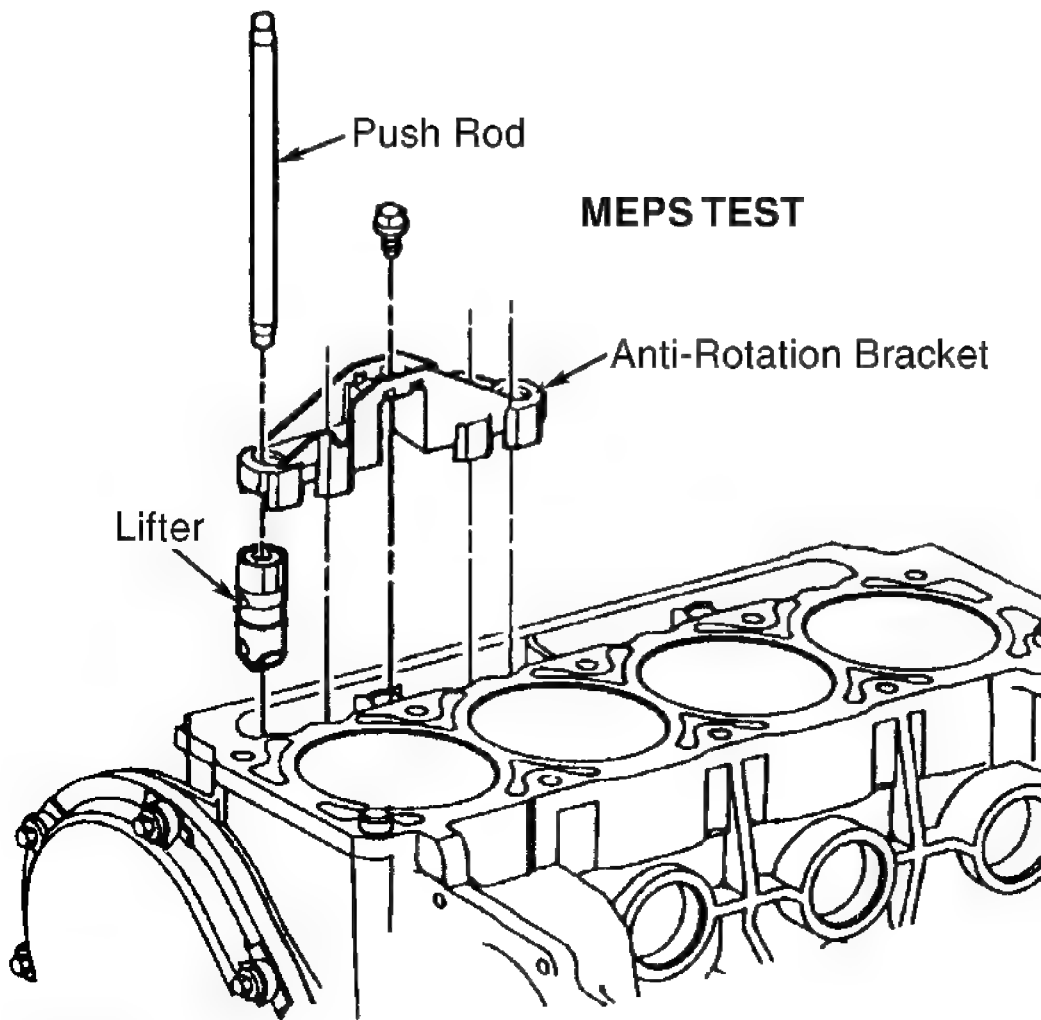
Removal

Remove cylinder head. See **CYLINDER HEAD** . Remove anti-rotation brackets. See **Fig. 4** . Note location of lifters for reassembly reference. Remove lifters.

NOTE: **Verify use of oversize valve lifters. Oversize valve lifters are identified by a mark on cylinder block, near lifter bore. If installing new lifter, coat bottom of lifter with Camshaft Lubricant (1052365) before installation.**

Installation

Install lifters in original locations. Tighten Anti-Rotation Bracket bolts to specification. See **TORQUE SPECIFICATIONS** . To complete installation, reverse removal procedure.



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Fig. 4: Identifying Push Rod, Anti-Rotation Bracket & Valve Lifter
Courtesy of GENERAL MOTORS CORP.

CAMSHAFT

NOTE: On Cavalier and Sunfire, engine must be removed from vehicle to replace camshaft.

Removal (Cavalier & Sunfire)

Remove engine. See **ENGINE** . Remove cylinder head. See **CYLINDER HEAD** . Remove valve lifters, front cover, timing chain, camshaft sprocket. Remove oil pump drive, camshaft position sensor from right side of cylinder block and camshaft thrust plate. Remove camshaft. If necessary, use Camshaft Bearing Remover/Installer (J-33049) to remove camshaft bearings.

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Removal (Sonoma & S10 Pickup)

Release fuel system pressure. See **FUEL PRESSURE RELIEF** . Disconnect and remove battery from vehicle. Drain cooling system. Remove upper and lower fan shrouds. Remove radiator and connections. Evacuate A/C system. Remove hose assembly from condenser. Remove air intake resonator, and remove evaporator tube from condenser. Remove insulator from condenser, and remove condenser from vehicle. Remove cylinder head. See **CYLINDER HEAD** . Remove valve lifters. Remove front cover. See **FRONT COVER** . Rotate crankshaft until number 1 piston is at top dead center. Remove oil pump drive and camshaft position sensor. Remove camshaft sprocket and timing chain. See **TIMING CHAIN & SPROCKETS** . Remove camshaft thrust plate bolts and camshaft position sensor. Remove camshaft.

Inspection

Measure camshaft journal diameter, lobe lift and runout. Replace camshaft and bearings if not within specifications. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.

NOTE: **If installing new camshaft, replace all lifters. Verify use of oversize valve lifters. Oversize lifters are identified by mark on cylinder block, near lifter bore.**

Installation

Install camshaft bearings (if removed), ensuring oil holes are aligned. For S10 and Sonoma, coat camshaft lobes, journals, and oil pump drive gear with engine assembly Prelube (1052367). Coat camshaft journals and bearings with a high viscosity Oil With Zinc (12345501) or equivalent. Install camshaft. Install camshaft thrust plate. To complete installation, reverse removal procedure. Tighten all fasteners to specification. See **TORQUE SPECIFICATIONS** . When installing A/C pipes, use NEW "O" rings, and coat with 525 viscosity refrigerant oil.

CRANKSHAFT REAR OIL SEAL

Removal

Disconnect negative battery cable. Remove transmission. For M/T, see appropriate article in CLUTCHES. For A/T, see appropriate TRANSMISSION REMOVAL & INSTALLATION article in TRANSMISSION SERVICING. For M/T vehicles, mark pressure plate assembly-to-flywheel relationship for installation reference. For M/T vehicles, remove clutch cover bolts, one turn each, until spring pressure is relieved. Remove clutch cover and disc. For all vehicles, remove flywheel. Remove seal from housing, being careful not to damage sealing surface of crankshaft. Note direction of seal installation.

Installation

1. Coat inner and outer seal surfaces with engine oil. Install NEW seal on mandrel of Rear Main Bearing Oil Seal Installer (J-34686) until dust lip bottoms against tool collar. See **Fig. 5** . Align seal installer dowel pin with dowel pin hole of crankshaft. Install seal installer on crankshaft.
2. Tighten seal installer bolts to 27-62 INCH lbs. (3-7 N.m). Tighten seal installer "T" handle until collar is even with cylinder block. Remove seal installer. To complete installation, reverse removal procedure. Tighten all fasteners to specification. See **TORQUE SPECIFICATIONS** .
3. Apply Thread Locking Compound (1052624) to flexplate/flywheel bolts. For M/T vehicles, use Clutch Alignment Arbor (J-29074 or J-33169) when installing clutch cover onto flywheel assembly, and lubricate inside diameter of clutch bearing with Lubricant (12345777).

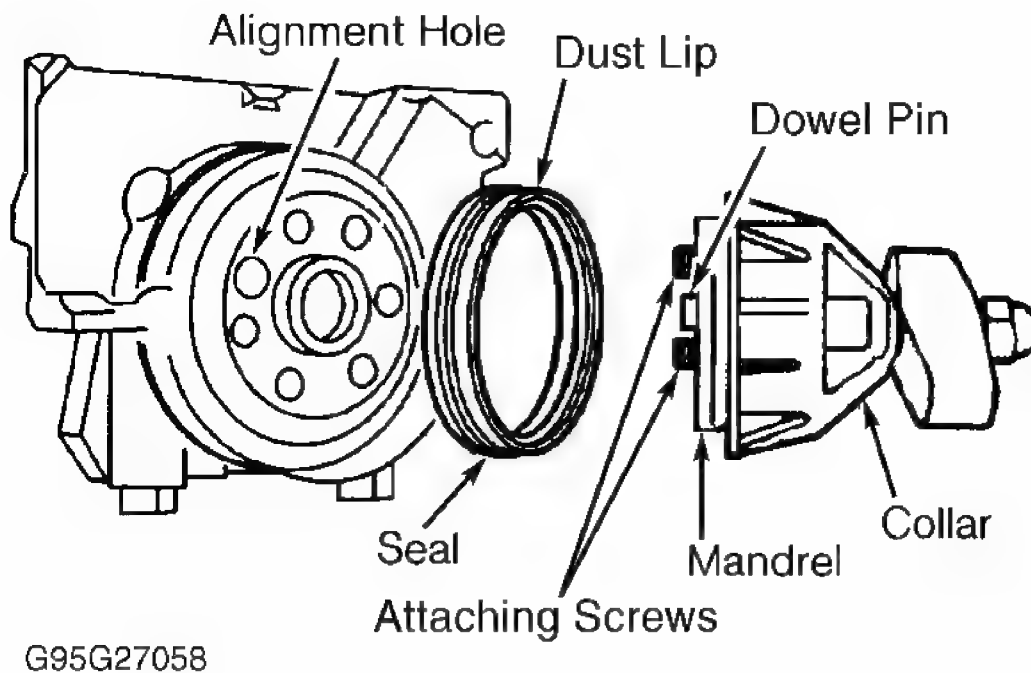


Fig. 5: Installing Rear Crankshaft Seal
Courtesy of GENERAL MOTORS CORP.

WATER PUMP

Removal (Cavalier & Sunfire)

Disconnect negative battery cable. Drain cooling system. Loosen water pump pulley bolts. Remove drive belt. Remove water pump pulley. Remove water pump and gasket.

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Removal (Sonoma & S10 Pickup)

1. Disconnect negative battery cable. Drain cooling system. Remove drive belt. Remove upper fan shroud and connections. Remove air cleaner outlet resonator fasteners. Remove resonator outlet duct. Disconnect vacuum brake booster hose at throttle body. Disconnect crankcase vent hose from top of engine, and remove air cleaner outlet resonator.
2. Remove radiator inlet hose from support, radiator and coolant outlet. Using 2 Fan Clutch Wrenches (J-41240), remove fan and fan clutch as assembly. Remove fan from clutch. Remove water pump pulley. Remove water pump and gasket.

Installation

To install, reverse removal procedure. Use NEW gasket. Apply Sealant (12346004) to water pump mounting bolts. Tighten all fasteners to specification. See **TORQUE SPECIFICATIONS** .

OIL PAN

Removal (Cavalier & Sunfire)

Disconnect negative battery cable. Raise and support vehicle. Remove right front wheel. Remove right engine splash shield, using Door Trim Pad & Garnish Clip Remover (J-38778) to remove push-in retainer. Drain engine oil. Remove starter and bracket, and set starter aside. Remove engine mount strut. Remove drive belt. Remove right front fender liner. Disconnect compressor clutch electrical connector. Remove compressor, and set aside with lines attached. Remove engine mount strut bracket. Remove oil pan.

Removal (Sonoma & S10 Pickup)

Remove engine from vehicle. See **ENGINE** under REMOVAL & INSTALLATION. Remove oil pan bolts and oil pan.

Installation

Apply a 1/8" (3 mm) bead of RTV sealant to oil pan side sealing flanges, to front of oil pan where it contacts front cover and to the ears of NEW oil pan rear seal. Install seal onto bottom of rear main bearing cap. Install oil pan. To complete installation, reverse removal procedure. Tighten all fasteners to specification. See **TORQUE SPECIFICATIONS** .

OVERHAUL

NOTE: For reassembly reference, label all electrical connectors, vacuum hoses and fuel lines before removal. Also place mating marks on engine hood and other major assemblies before removal.

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CYLINDER HEAD

Gasket Surfaces

If warpage of head gasket surface or manifold surfaces exceeds specification, resurface or replace cylinder head as necessary. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. DO NOT remove more than .010" (.25 mm) material from head gasket surface.

Valve Springs

If any valve spring free length, out-of-square, or pressure is not within specification, replace valve spring(s). See **VALVES & VALVE SPRINGS** table under ENGINE SPECIFICATIONS.

Valve Stem Oil Seals

If installing oversize valves, use oversize seals. Ensure seal is fully seated on guide. Intake and exhaust seals are different.

Valve Guides

If oil clearance exceeds specification, ream valve guides .0394" (1.000 mm) for oversize valves. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. DO NOT knurl valve guides.

Valve Seats

If valve seat runout and width are not within specification, grind valve seat or replace cylinder head as necessary. If valve seat is ground, it may be necessary to shim the valve spring in order to obtain proper spring installed height. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.

Valves

Machine valve face if rough. If valve head margin is not within specification, replace valve. See **VALVES & VALVE SPRINGS** table under ENGINE SPECIFICATIONS.

Valve Seat Correction Angles

If seat contact is too close to margin, machine seat with 30-degree stone. If seat contact is too close to stem, machine seat with 45-degree stone. If seat is too narrow, widen it with 45-degree stone. If seat is too wide, narrow it with 60-degree stone.

CYLINDER BLOCK ASSEMBLY

NOTE: Before disassembly, mark all parts for reassembly

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reference.

Piston & Assembly

Ensure bump on connecting rod on top of large end where it forms the connecting rod beam faces away from mark on top of piston. Install piston with mark on top of piston toward front of engine.

Fitting Pistons

Measure cylinder bore diameter at center of bore. Measure piston diameter at 90-degree angle to piston pin .437" (11 mm) above bottom of piston skirt. Determine piston clearance. If piston clearance is not within specification, machine cylinder bore and/or install oversize piston as necessary. See **PISTONS, PINS & RINGS** and **CYLINDER BLOCK** tables under ENGINE SPECIFICATIONS.

Piston Rings

Measure piston ring end gap and side clearance. If end gap and side clearance are not within specification, replace piston rings and/or piston as necessary. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS. Install piston rings with piston ring installer in order to not damage rings. Install first ring with either side up. Install second ring with identification mark on ring land facing top of piston. Properly position ring end gaps around circumference of piston. See **Fig. 6**.

Rod Bearings

If rod bearing oil clearance is not within specification, machine crankshaft rod bearing journals and install undersize bearings. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.

Crankshaft & Main Bearings

If crankshaft main bearing oil clearance, out-of-round or taper is not within specification, machine crankshaft main bearing journals and install undersize bearings. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.

Thrust Bearing

Thrust bearing is part of main bearing No. 4. Pry crankshaft toward rear of engine. Measure clearance between thrust bearing face and crankshaft. If clearance is not within specification, replace thrust bearing and/or crankshaft. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.

Deck Surface Warpage

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If deck surface warpage exceeds specification, machine or replace cylinder block. DO NOT remove more than .010" (.25 mm) material from deck surface.

Valve Lifter Bores

Oversize valve lifters are available to compensate for excessive clearance between lifter and bore. Oversize lifter is indicated on cylinder block, near lifter bore.

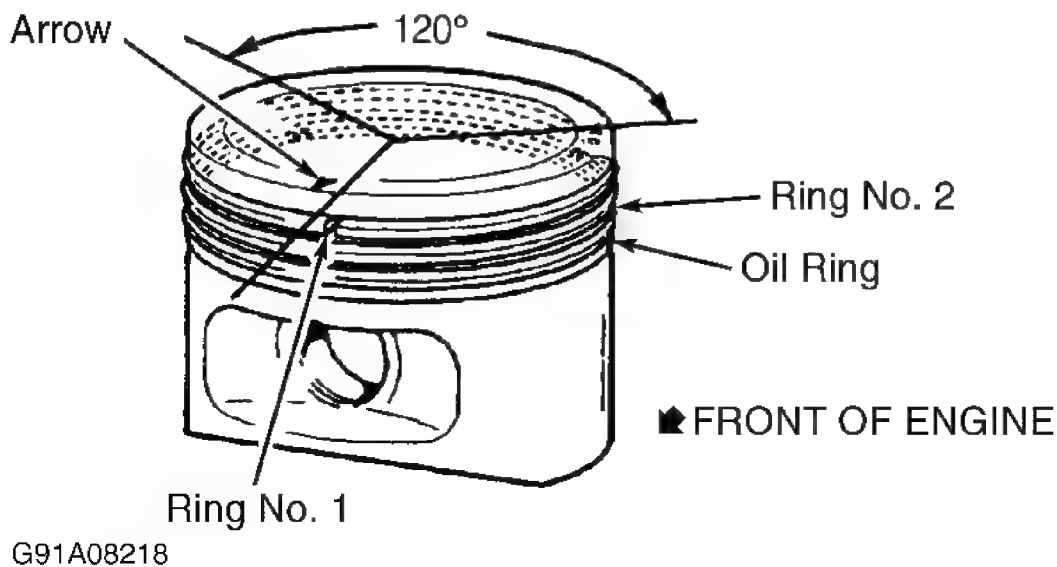


Fig. 6: Positioning Piston Ring End Gaps
Courtesy of GENERAL MOTORS CORP.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

A camshaft-driven, gear-type oil pump is mounted at bottom of cylinder block and is accessible with oil pan removed. Oil pump supplies pressurized oil to internal passages of cylinder block. Internal passages intersect with hydraulic valve lifter bosses where oil flows to main and camshaft bearings and lifters. See **Fig. 7**.

Crankcase Capacity

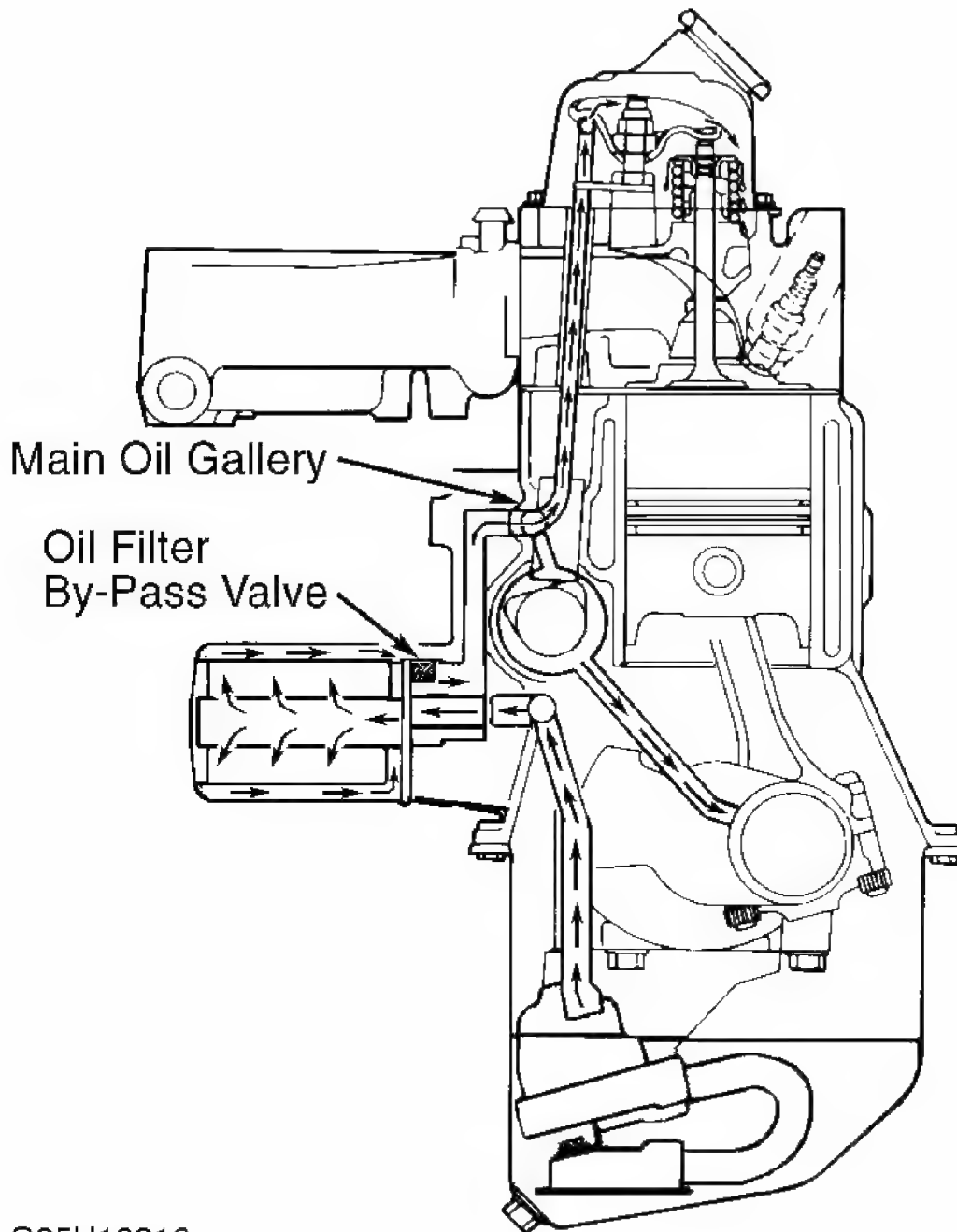
Engine oil capacity is about 4.5 qts. (4.3L) without oil filter change. When changing oil filter, add more oil if necessary.

Oil Pressure

Normal oil pressure is 56 psi (3.9 kg/cm²) at 3000 RPM.

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Fig. 7: Cross-Sectional View Of Engine Oil Circuit (Typical)
Courtesy of GENERAL MOTORS CORP.

OIL PUMP

WARNING: Pressure regulator valve spring is under pressure. Use caution when removing retaining pit to prevent bodily

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injury.

Removal & Disassembly

Remove oil pan. See **OIL PAN** under REMOVAL & INSTALLATION. For S-10 Pickup and Sonoma, remove oil pump drive. Remove bolt securing oil pump to rear main bearing cap. Remove oil pump and extension shaft. Remove extension shaft and retainer from oil pump. Disassemble pump.

Inspection

1. Replace extension shaft retainer if cracked. Inspect components for damage. Measure depth and diameter of gear housing. Measure gear diameter and gear length. Measure gear lash (clearance between tip of gear teeth of both gears). Measure gear side clearance (clearance between tip of gear tooth and housing).
2. Using straightedge and feeler gauge, measure gear end clearance (clearance between cover plate and gear). Determine clearance between pressure regulator valve and bore. If clearances are not within specification, replace components as necessary. See **OIL PUMP SPECIFICATIONS** table.

CAUTION: Before installing gears, pack oil pump cavities with petroleum jelly to prime pump. Use only original equipment gaskets when assembling oil pump, as gasket thickness is critical. Pick-up tube must be replaced if removed.

Reassembly & Installation

To reassemble, reverse disassembly procedure. To keep extension shaft retainer from cracking, heat it in hot water before installing it onto oil pump. To install, reverse removal procedure. Tighten oil pump retaining bolt to specification. See **TORQUE SPECIFICATIONS**.

OIL PUMP SPECIFICATIONS

Application	In. (mm)
Gear	
Diameter	1.498-1.500 (38.05-38.10)
End Clearance	.002-.007 (.051-.178)
Lash	.004-.008 (.102-.203)
Length	1.199-1.200 (30.45-30.48)
Side Clearance	.001-.004 (.025-.102)
Gear Housing	

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Depth	1.195-1.198 (30.35-30.43)
Diameter	1.503-1.506 (38.18-38.25)
Valve-To-Bore Clearance	.0015-.0035 (.0381-.0889)

TORQUE SPECIFICATIONS**TORQUE SPECIFICATIONS**

Application	Ft. Lbs. (N.m)
A/C Compressor	
Cavalier & Sunfire	
Front Mounting Bolt	33 (45)
Rear Mounting Bolt	48 (65)
Upper Mounting Bracket Bolt	37 (50)
Sonoma & S10 Pickup	
Mounting Bolts	37 (50)
Rear Bracket Bolts	18 (25)
Accessory Mounting Bracket-To-Engine Bolts (Cavalier & Sunfire)	37 (50)
Camshaft Sprocket Bolt	96 (130)
Catalytic Converter-To-Exhaust Manifold Bolts (Cavalier & Sunfire)	33 (45)
Catalytic Converter-To-Exhaust Manifold Pipe Flange Nuts (Sonoma & S10 Pickup)	26 (35)
Connecting Rod Cap Nuts	38 (52)
Crankshaft Balancer Bolts (Sonoma & S10 Pickup)	70 (95)
Crankshaft Main Bearing Cap Bolts	
Step 1	31 (50)
Step 2	70 (95)
Crankshaft Pulley Mounting Bolts	37 (50)
Crankshaft Pulley Hub Bolt	77 (105)
Cylinder Head Bolts ⁽¹⁾	
Step 1	
Long Head Bolts	46 (63)
Short Head Bolts	43 (58)
Step 2	Tighten an Additional 90 Degrees

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Drive Axle Nut (Cavalier & Sunfire)	148 (200)
Drive Belt Tensioner Pulley Bolt	37 (50)
Engine	
Cavalier & Sunfire	
Mount Strut Bolts	74 (100) + 90 degrees
Mount Strut Bracket Bolts	49 (66)
Mount-To-Body Nuts	55 (75)
Mount-To-Bracket Bolts	44 (60) + 90 degrees
Sonoma & S10 Pickup	
Lift Bracket-To-Engine Rear Nut	22 (30)
Mount Through-Bolts	33 (45)
To-Transmission Brace Rod Mounting Bolts	37 (50)
Engine Oil Cooler Lines-To-Engine Oil Filter Adapter Bolt (Sonoma & S10 Pickup)	26 (35)
Exhaust Manifold Pipe-To-Exhaust Manifold Flange Bolts (Sonoma & S10 Pickup)	22 (30)
Fan Pulley Bolts (Sonoma & S10 Pickup)	22 (30)
Fan-To-Fan Clutch Bolts (Sonoma & S10 Pickup)	24 (33)
Flexplate/Flywheel-To-Crankshaft Bolts ⁽²⁾	55 (75)
Crossmember Extension Brace-To-Crossmember (Cavalier & Sunfire)	53 (72)
Crossmember Mounting Bolts ⁽³⁾ (Cavalier & Sunfire)	81 (110)
Fuel Pipe Fittings	24 (33)
Generator	
Cavalier & Sunfire	
Lower Mounting Bolt	37 (50)
Upper Mounting Bolts	22 (30)
Sonoma & S10 Pickup	
Brace-To-Engine Nuts	18 (25)
Front Mounting Bolt	18 (25)
Rear Mounting Bolt	37 (50)
Hood Hinge Attaching Bolts/Nuts	18 (25)
Intake Manifold	
Nuts/Bolts	18 (25)
Studs	9 (12)
Intermediate Pipe-To-Catalytic Converter Bolts (Cavalier &	22 (30)

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Sunfire)	
Intermediate Shaft Lower Pinch Bolt (Cavalier & Sunfire)	30 (40)
Lower Control Arm (Cavalier & Sunfire)	
Ball Joint-To-Knuckle Nut	41-48 (55-65)
Front Mounting Bolt	79 (107)
Rear Mounting Bolt	125 (170)
Muffler-To-Catalytic Converter Flange Nuts (Sonoma & S10 Pickup)	26 (35)
Oil Pump Drive Bolt	18 (25)
Outer Tie Rod-To-Knuckle Nut (Cavalier & Sunfire)	33 (45)
Oxygen Sensor Fasteners	30 (41)
Power Steering	
Cavalier & Sunfire	
Pump Mounting Bolts	22 (30)
Sonoma & S10 Pickup	
Pump Bracket-To-Cylinder Head Stud Nuts	37 (50)
Pump Front Mounting Bolt	22 (30)
Pump Lower Bracket Bolt	37 (50)
Pump Rear Mounting Bracket Fasteners	37 (50)
Pump-To-Accessory Mounting Bracket	22 (30)
Stabilizer Bar Bracket Bolts (Cavalier & Sunfire)	49 (66)
Stabilizer Bar Link-To-Knuckle Nut (Cavalier & Sunfire)	13 (17)
Starter Mounting Bolts	
Cavalier & Sunfire	37 (50)
Sonoma & S10 Pickup	32 (43)
Steering Gear-To-Crossmember Mounting Bolts (Cavalier & Sunfire)	89 (120)
Tie Rod Jam (Adjuster) Nut (Cavalier & Sunfire)	55 (75)
Timing Chain Tensioner Bolt	18 (25)
Torque Converter Bolts (Cavalier & Sunfire)	46 (62)
Transaxle (Cavalier & Sunfire)	
Mounting Bolts	55 (75)
Through-Bolt	
Front	44 (60)
Rear	55 (75)
Valve Rocker Arm Bolts	
Cavalier & Sunfire	22 (30)
Sonoma & S10 Pickup	18 (25)
Water Pump Pulley Bolts	

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Cavalier & Sunfire	22 (30)
Sonoma & S10 Pickup	18 (25)
INCH Lbs. (N.m)	
Anti-Rotation Bracket Bolts	97 (11)
Camshaft Thrust Plate Bolts	106 (12)
Exhaust Manifold Nuts	115 (13)
Front Cover Bolts	97 (11)
Oil Pan Fasteners	89 (10)
Oil Pump Cover Bolts	89 (10)
Resonator Upper Attaching Bolt (Cavalier & Sunfire)	61 (7)
Throttle Body Attaching Bolts	89 (10)
Valve Rocker Arm Cover Bolts	89 (10)
(1) Tighten in sequence. See Fig. 2 .	
(2) Apply thread locking compound to bolts.	
(3) Hand tighten first.	

ENGINE SPECIFICATIONS**GENERAL SPECIFICATIONS**

Application	Specification
Displacement	134 Cu. In. (2.2L)
Bore	3.50" (89 mm)
Stroke	3.46" (88 mm)
Compression Ratio	8.85:1
Fuel System	MFI

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECIFICATIONS

Application	In. (mm)
Crankshaft End Play	.002-.007 (.05-.18)
Main Bearings	
Journal Diameter	2.4945-2.4954 (63.360-63.384)
Journal Out-Of-Round	.00019 (.0048)
Journal Taper	.00019 (.0048)
Oil Clearance	.0006-.0019 (.015-.048)
Connecting Rod Bearings	
Journal Diameter	1.9983-1.9994

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	(50.756-50.784)
Journal Out-Of-Round	.00019 (.0048)
Journal Taper	.00019 (.0048)
Oil Clearance	.00098-.0031 (.0249-.079)

CONNECTING RODS SPECIFICATIONS

Application	In. (mm)
Maximum Bend	(1)
Maximum Twist	(1)
Side Play	.0039-.0149 (.099-.378)

(1) Replace rod if any bend or twist exists.

PISTONS, PINS & RINGS SPECIFICATIONS

Application	In. (mm)
Pistons	
Clearance	(1) .00059-.00185 (.0150-.0470)
Diameter	(2)
Pins	
Diameter	.8000-8002 (20.320-20.325)
Piston Fit	
2000	.00031-.00061 (.0079-.0155)
2001	.00031-.00071 (.0079-.0180)
Rod Fit	
2000	.0013-.0025 (.033-.064)
2001	.0008-.0020 (.020-.051)
Rings	
No. 1	
End Gap	.010-.020 (.250-.510)
Side Clearance	.0020-.0035 (.051-.089)
No. 2	
End Gap	.0012-.0177 (.030-.450)
Side Clearance	
2000	.0016-.0031 (.041-.079)
2001	.0008-.0031 (.020-.079)
No. 3 (Oil)	
End Gap	.010-.030 (.254-.762)

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Side Clearance

.0005-.0087 (.013-.221)

(1) Measured 1.68" (42.7 mm) from top of piston.

(2) Information is unavailable from manufacturer.

CYLINDER BLOCK SPECIFICATIONS

Application	In. (mm)
Cylinder Bore	
Standard Diameter	3.5036-3.5043 (88.991-89.009)
Maximum Taper	.0005 (.013)
Maximum Out-Of-Round	.0005 (.013)
Maximum Deck Warpage	(1)
(1) If more than .0100" (.250 mm) material must be removed from original surface of deck, replace cylinder block.	

VALVES & VALVE SPRINGS SPECIFICATIONS

Application	Specification
Valves	
Face Angle	45°
Head Diameter	
Exhaust	1.45" (37 mm)
Intake	1.73" (44 mm)
Head Margin	
Exhaust	.073-.083" (1.87-2.13 mm)
Intake	.048-.058" (1.23-1.49 mm)
Face Runout (Maximum)	.0014" (.036 mm)
Valve Springs	
Free Length	1.910" (48.514 mm)
Out-Of-Square	(1)
Lbs. @ In. (kg @ mm)	
Valve Spring Pressure (Minimum)	
Valve Closed	
2000	72.8-81.2 @ 1.600 (33.02-36.83 @ 40.6)
2001	73.1-81.2 @ 1.600 (33.15-36.83 @ 40.6)
Valve Open	201-215 @ 1.175 (91.17-97.52 @ 29.9)

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(1) Information is unavailable from manufacturer.

CYLINDER HEAD SPECIFICATIONS

Application	Specification
Maximum Warpage	(1) .004" (.10 mm)
Valve Seats	
Intake Valve	
Seat Angle	45 degrees
Seat Width	.110" (2.79 mm)
Seat Runout (Maximum)	(2)
Exhaust Valve	
Seat Angle	45 degrees
Seat Width	.138" (3.51 mm)
Seat Runout (Maximum)	(2)
Valve Guides	
Intake Valve Stem-To-Guide Oil Clearance	.0007-.0020" (.018-.051 mm)
Exhaust Valve Stem-To-Guide Oil Clearance	.0014-.0029" (.036-.074 mm)
(1) If more than .010" (.25 mm) material must be removed from original surface of cylinder head, replace cylinder head.	
(2) Not provided by manufacturer.	

CAMSHAFT SPECIFICATIONS

Application	In. (mm)
Journal Diameter	1.868-1.869 (47.45-47.47)
Lobe Lift (Intake and Exhaust)	
2000	.2630 (6.680)
2001	.2633 (6.687)
Oil Clearance	
2000	.0005-.0035 (.013-.089)
2001	.0015-.0035 (.038-.089)